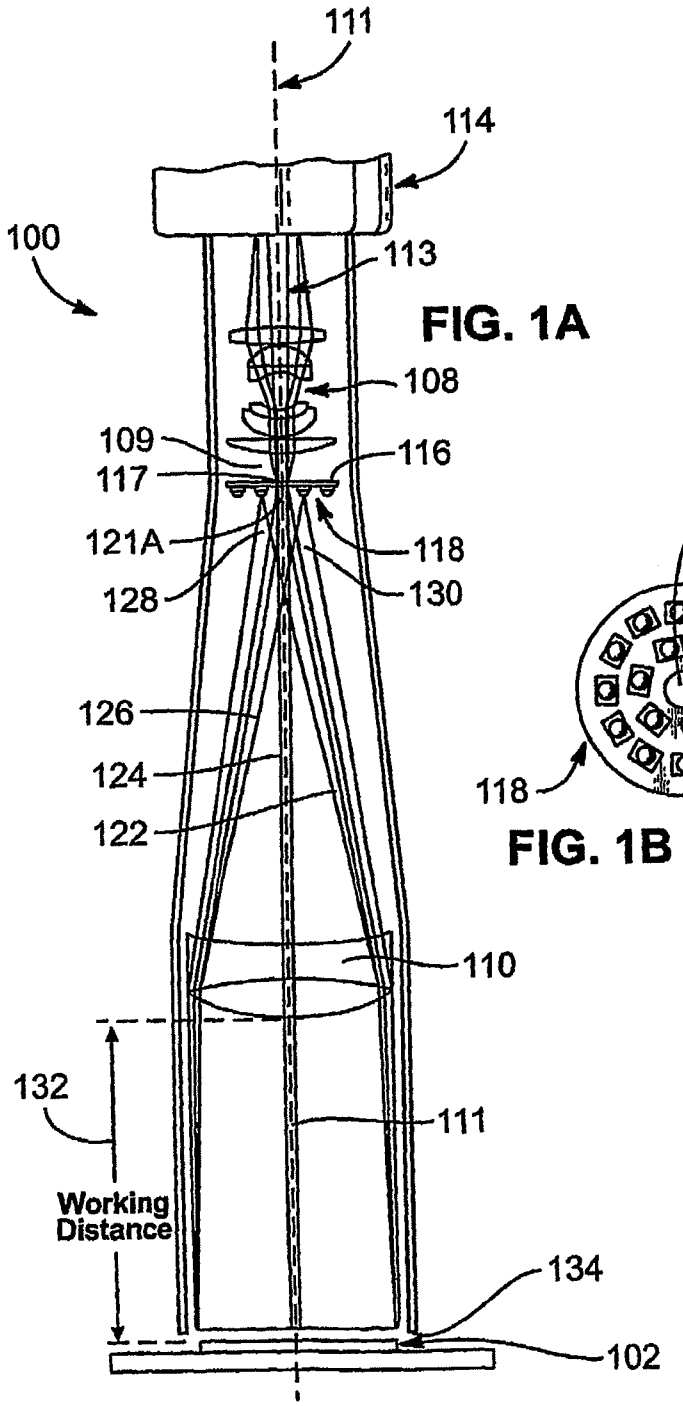


FIG. 1A

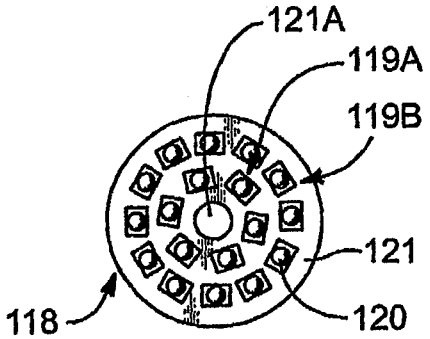


FIG. 1B (Prior Art)

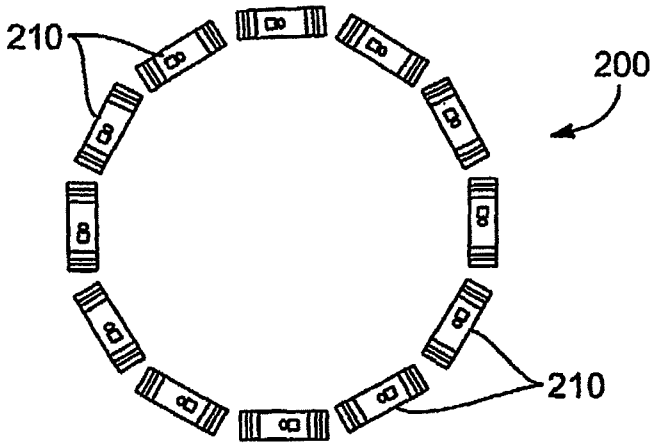


FIG. 2

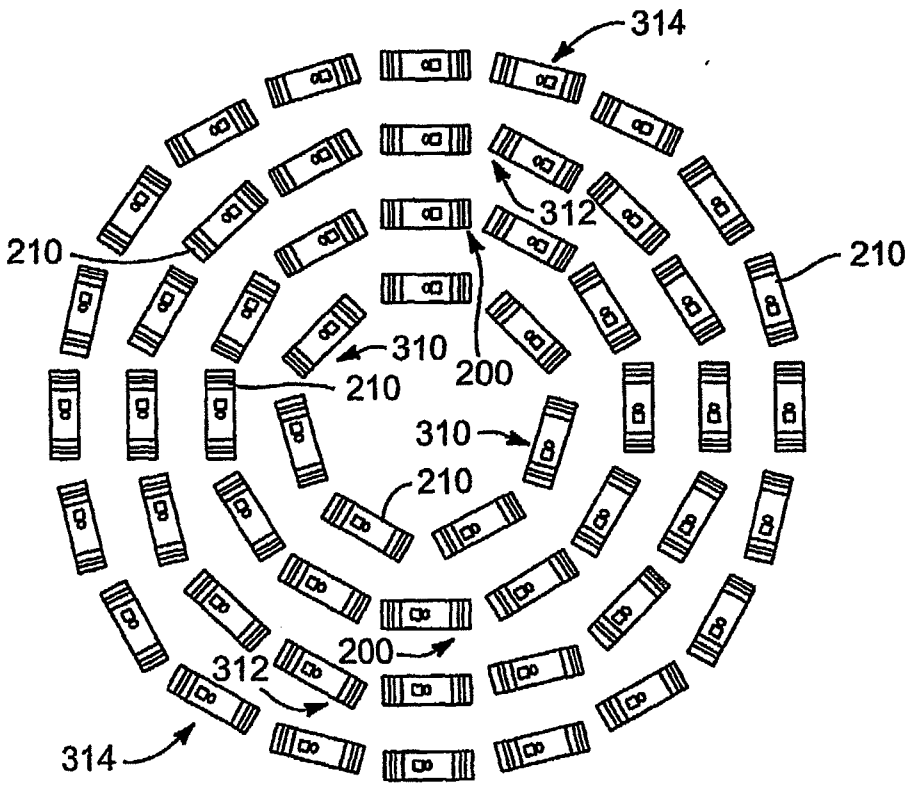


FIG. 3

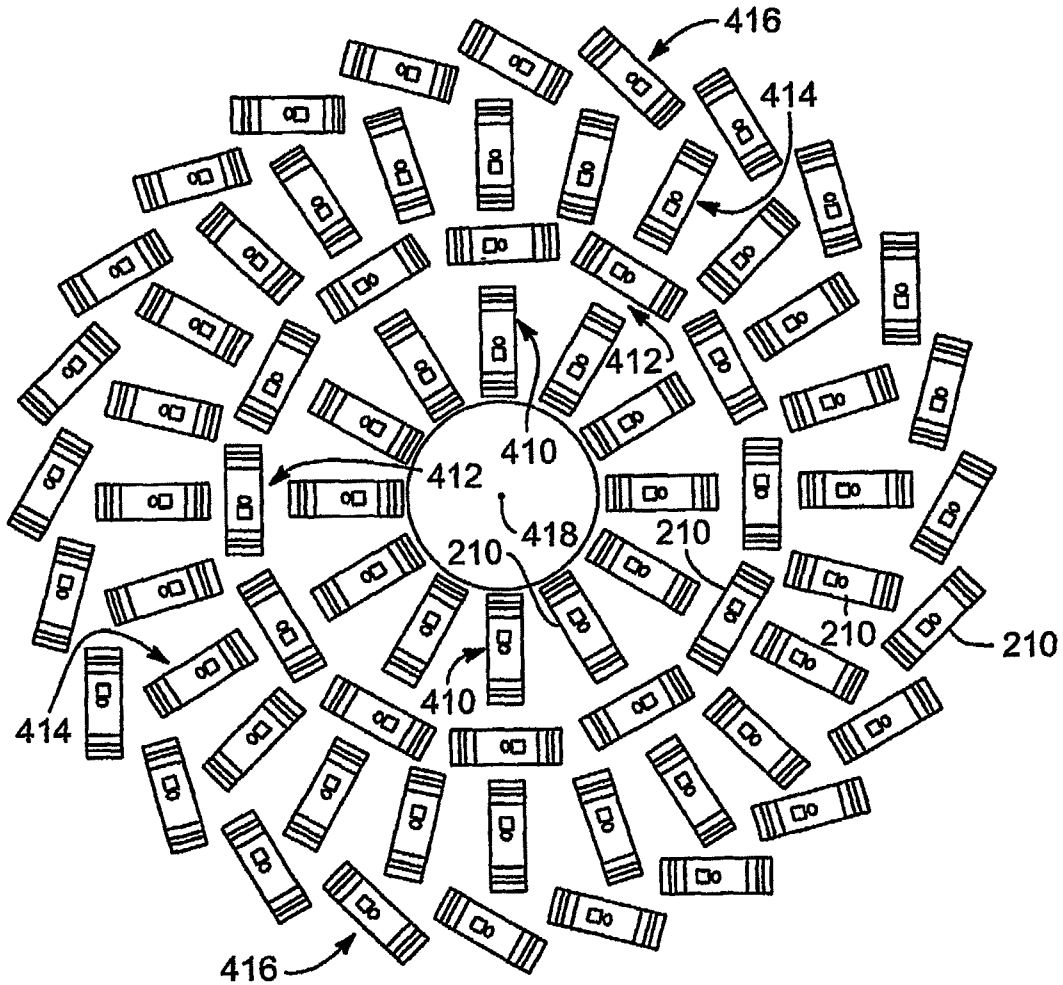


FIG. 4

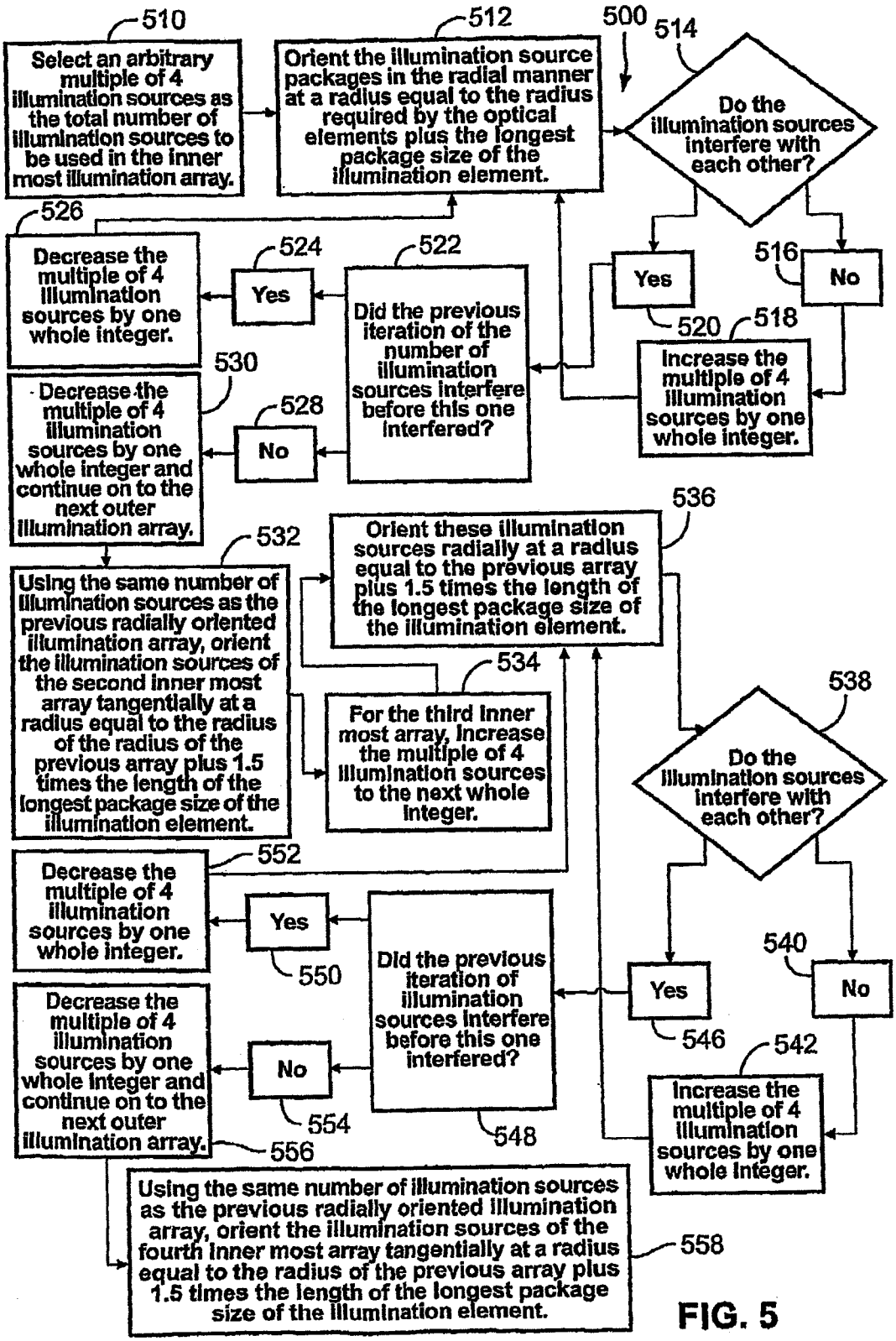

510
Select an arbitrary multiple of 4 illumination sources as the total number of illumination sources to be used in the inner most illumination array.
512
Orient the illumination source packages in the radial manner at a radius equal to the radius required by the optical elements plus the longest package size of the illumination element.
500
514
Do the illumination sources interfere with each other?
Yes
516
No
520
518
Increase the multiple of 4 illumination sources by one whole integer.
526
Decrease the multiple of 4 illumination sources by one whole integer.
524
Yes
522
Did the previous iteration of the number of illumination sources interfere before this one interfered?
530
Decrease the multiple of 4 illumination sources by one whole integer and continue on to the next outer illumination array.
528
No
536
Orient these illumination sources radially at a radius equal to the previous array plus 1.5 times the length of the longest package size of the illumination element.
532
Using the same number of illumination sources as the previous radially oriented illumination array, orient the illumination sources of the second inner most array tangentially at a radius equal to the radius of the radius of the previous array plus 1.5 times the length of the longest package size of the illumination element.
534
For the third inner most array, increase the multiple of 4 illumination sources to the next whole integer.
538
Do the illumination sources interfere with each other?
552
Decrease the multiple of 4 illumination sources by one whole integer.
Yes
550
Did the previous iteration of illumination sources interfere before this one interfered?
548
Yes
546
540
No
542
Increase the multiple of 4 illumination sources by one whole integer.
Decrease the multiple of 4 illumination sources by one whole integer and continue on to the next outer illumination array.
No
554
556
Using the same number of illumination sources as the previous radially oriented illumination array, orient the illumination sources of the fourth inner most array tangentially at a radius equal to the radius of the previous array plus 1.5 times the length of the longest package size of the illumination element.
558

FIG. 5

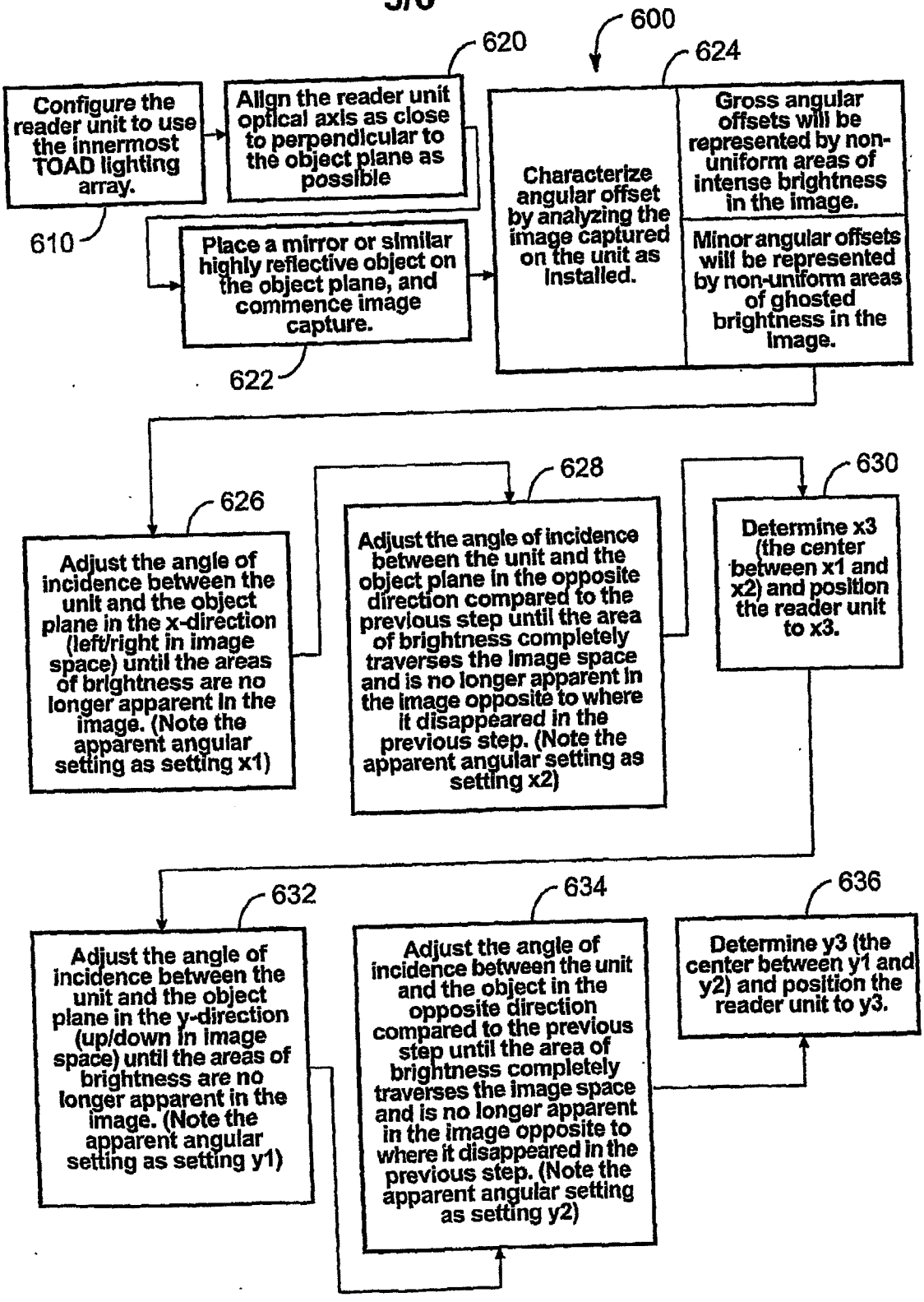

600
610
Configure the reader unit to use the innermost TOAD lighting array.
620
Align the reader unit optical axis as close to perpendicular to the object plane as possible
622
Place a mirror or similar highly reflective object on the object plane, and commence image capture.
624
Characterize angular offset by analyzing the image captured on the unit as installed.
Gross angular offsets will be represented by non-uniform areas of intense brightness in the image.
Minor angular offsets will be represented by non-uniform areas of ghosted brightness in the image.
626
Adjust the angle of incidence between the unit and the object plane in the x-direction (left/right in image space) until the areas of brightness are no longer apparent in the image. (Note the apparent angular setting as setting x1)
628
Adjust the angle of incidence between the unit and the object plane in the opposite direction compared to the previous step until the area of brightness completely traverses the image space and is no longer apparent in the image opposite to where it disappeared in the previous step. (Note the apparent angular setting as setting x2)
630
Determine x3 (the center between x1 and x2) and position the reader unit to x3.
632
Adjust the angle of incidence between the unit and the object plane in the y-direction (up/down in image space) until the areas of brightness are no longer apparent in the image. (Note the apparent angular setting as setting y1)
634
Adjust the angle of incidence between the unit and the object in the opposite direction compared to the previous step until the area of brightness completely traverses the image space and is no longer apparent in the image opposite to where it disappeared in the previous step. (Note the apparent angular setting as setting y2)
636
Determine y3 (the center between y1 and y2) and position the reader unit to y3.

FIG. 6

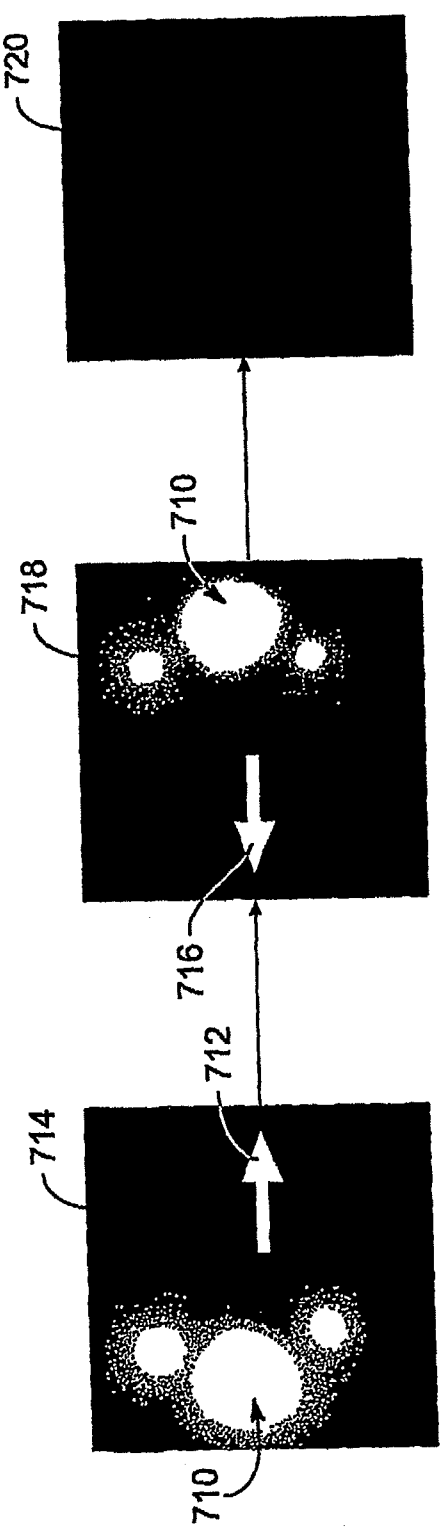


FIG. 7A

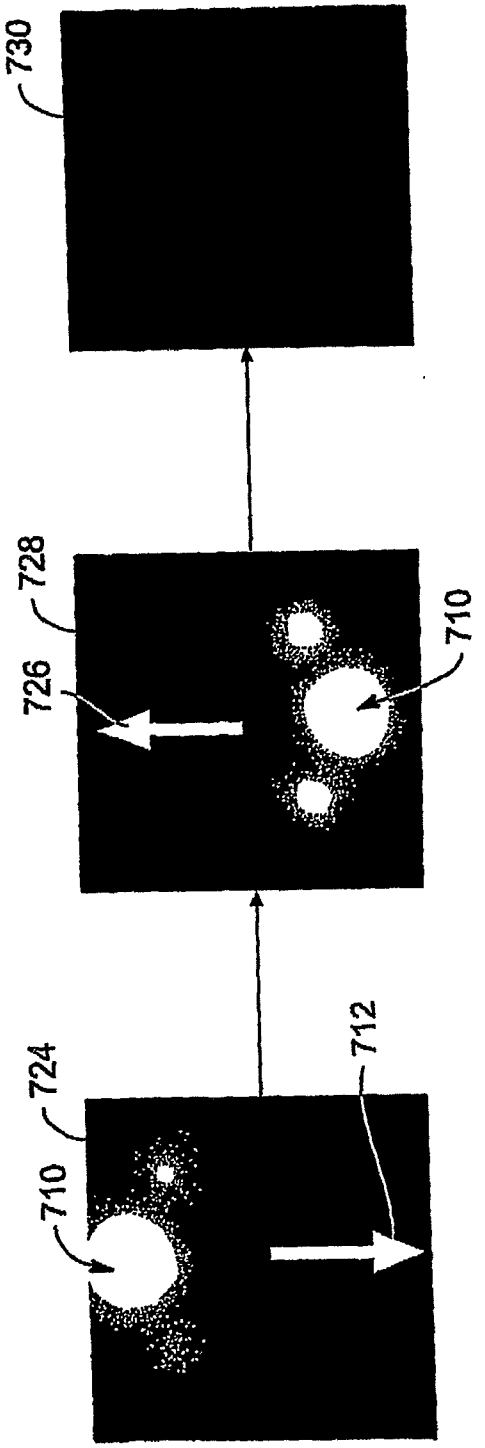


FIG. 7B